

**Technology Entrepreneurship Initiative**

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## Executive Summary

Technology Entrepreneurship (TE) is the process of taking a scientific breakthrough or invention that can solve an often long-standing problem and transform what is simply a technical idea into a business venture that can deliver the innovation to the point of need and do so profitably. It is a very multi-disciplinary process and, as in the example of taking a drug compound discovered in the lab all the way to your drugstore and health insurance approved prescription plan, it can be a long and complex one. Collaboration over the past 2 years between the Hankamer School of Business and the School of Engineering and Computer Science (ECS) has produced rapid expansion of the program in breadth, external recognition and support, and potential to make a broad impact<sup>1</sup>. But much is needed to sustain that impact and expand it. A “Good news and Bad news” moniker fits the current situation in multiple ways:

1. An interdisciplinary, experiential learning based approach for developed by Entrepreneurship and ECS faculty has proven to be effective on our campus and embedded into the Baylor I5 China<sup>2</sup> summer program, but the very hands-on, learning laboratory style that makes it effective also demands high degree of engagement from a range of real-world experienced faculty.
2. Finding room in ECS majors’ degree plans for the business and global competencies called for by many in Engineering education<sup>3</sup> is difficult if the students are to finish in four years, but the pilot program underway now at Baylor holds great promise for not ECS, but also for replication to other technical areas such as Chemistry as well because the new competencies are merged into existing courses without a net add of hours.
3. The costs to deliver this advantageous, cross-disciplinary learning opportunity that models the world in which they will spend their professional lives to a broad cross-section of technical and business students are significant, but the business leaders who hire them understand the value and are willing to make the needed investments in order to assure their access to the exceptional graduates who will result.
4. Companies like to support and participate in programs that are already in place so that their impact is seen quickly and this can lock development efforts into a “chicken and egg” scenario, but in this case a seed fund donation by Hewlett Packard has already provided the needed money to cover the startup costs while long-term support from a wider range of firms and individuals is developed.

The Technology Entrepreneurship Initiative seeks approval to develop those needed forms of long-term industry-based support that will enable sustained growth of the programs impact on learning. It will further Baylor 2012 Imperatives I (through increased faculty-student interaction, intensive demands for writing and speaking in real-world context, and high demands for critical thinking, research and analysis) and Imperative XI (by a highly immersive approach to summer abroad study that connects undergraduate and graduate students as well as faculty with colleagues, students and practitioners abroad).

### What is the proposed activity?

The timeframe for action is defined by the reality that the HP seed donation will only provide the needed funding for Technology Entrepreneurship programming for three years. During that time-frame it is imperative that we build an ongoing base of industrial sponsorship that will enable hiring of clinical and adjunct faculty needed to deliver the highly interactive, applied learning courses. The TE initiative will form an Advisory Board comprised of approximately 8 or 10 companies and individuals whose interests line up with those of the program. Members will

- Commit to an annual contribution of about \$25K to the program for three years
- Give guidance to the participating faculty and students to assure relevancy

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<sup>1</sup>*Technically Entrepreneurs*, Baylor Business Review, Fall 2006.

<sup>2</sup> See *Immersion and Innovation in China*, Baylor Magazine, Fall 2007.

<sup>3</sup> James J. Duderstadt, *Engineering for a Changing World*, The Millennium Project, University of Michigan, 2007.

- Have opportunity to have their projects preferentially selected for student work
- Interact with the Business and Engineering school faculties through events in conjunction with board meetings so that research opportunities can be explored

#### Why should it be implemented?

- Baylor 2012 Imperatives call for this type of education and global focus
- Students in these applied fields will excel with the tools this program delivers
- The needs of a flattening, technology-expanding presents global scale problems that our graduates need to be prepared to solve include energy, climate change and so on.

#### How much will it cost?

This initiative is entirely self funded, and will proceed at a pace allowed by its success in developing sponsorships or other forms of external support. Its initial goal is to achieve \$200K per year by the end of the first three year period.

#### How will it be assessed?

The TE initiative has several directly measurable outcomes as students, employers / recruiters and the entrepreneurs and companies who sponsor projects vote with their feet, their checkbooks and their feedback. Indirect measures of success include the rankings improvements of the Entrepreneurship and Engineering programs.

### **Statement of Need**

One way to view Baylor's recently adopted QEP, and specifically its elements of forming interdisciplinary Enhanced Learning Groups and emphasizing undergraduate research, is as conviction that a premier educational product requires opportunities for collaboration and analytical investigation "early and often" in a student's stay at the University. The TE Initiative will afford those very opportunities to students whose interests lie in the broad field of using new inventions to create sustainable value for others and themselves. It is fully independent from the current proposals being developed for an Entrepreneurship ELG that will serve as a pilot for a new Living and Learning Center in Entrepreneurship that seeks to engage students from all over campus in the process of making their creative passions a reality that produced benefit for others but has synergism with their activities and goals. The TE Initiative thus responds to the same needs that fueled the selection of the QEP elements, and helps Baylor execute on those elements with a particular focus on the Entrepreneurship and Engineering / Computer Science student populations.

These students need to be prepared to "play" on a very rapidly changing field in which many of the "rules of the game" are quite different from even 10 years ago, and will continue to evolve. This challenge has been studied extensively and recently summarized in a comprehensive report by President Emeritus James J. Duderstadt from the University of Michigan (referenced above). Some readily visible realities that will be included on their radar screens include:

- **Accelerating development and dissemination of technology into nearly every facet of life and work.** The speed of technical change demands complete retooling of knowledge base for the "techies" during the course of their careers. This in turn requires a learning experience that is about discovery and synthesis in addition to mastery of the current state of the art if they will be equipped to avoid becoming quickly obsolete. And for the entrepreneur, the pervasiveness of technology means they are required to understand how to use it, value it, and perhaps manage its development. To paraphrase an old jingle – "Technology isn't just for techies anymore".
- **Globally expanding role of entrepreneurial ventures in driving of economic growth.** From micro-financed ventures at the "bottom of the pyramid" to billion-dollar innovations such as the Google® search engine, new wealth at every scale is being created by people who bring the right combination of ideas and resources together to start new businesses that meaningfully address things they care about. The jobs we do in the future will likely have more to what we can create than who we can get to hire us. So a

second pass at the jingle might be “Entrepreneurship isn’t just for business majors anymore”.

- **World-flattening forces that open everyone to competition from everywhere.** The world as described by Thomas Friedman as flat (or rapidly flattening) is one in which approximately ten engineers will graduate in China for every one in the United States, and the opportunity to create “the next Google” is just as attractive and just as visible to all these players. Similar ratios hold for the number of business degrees earned in India vis-à-vis here in America. Our graduates do have an enormous advantage of a culture that has long excelled in both technical innovation and business risk tolerance that has shaped them from an early age. They need to be prepared to utilize these advantages on the truly global stage they will enter when they finish at Baylor. By engaging in this initiative’s programs they gain not only insight into what the opportunities are around the world but also learn first-hand how adapt their talents and perspectives to maximize their impact.
- **Increasing interdependencies on global scale solutions.** This population of students will inherit some of the knottiest problems the world has faced, and which have no solutions except solutions that work globally. Examples such as climate change, energy sourcing, drinkable water supply, anti-bird-flu vaccinations and food supply all fit this category. Answers will come from highly skilled collaborators from across many disciplines besides engineering, computer science and entrepreneurship, but certainly the need for *these* graduates to effectively engage in globally scaled, financially sustainable technical innovation is clear.

Given these demands, it would appear that the world agrees with us at Baylor University – the need for a new kind of educational experience is high and much depends on our success. The TE Initiative will make our efforts in this arena sustainable not only with ongoing outside funding of its teaching activities, but also in creating new connecting points for industry sponsored research that further assure applied learning and early development of investigative and analytical skills in a cross-disciplinary environment.

## **Environmental Assessment – Strengths, Weaknesses, Opportunities and Threats**

### What are the internal strengths that relate to the proposed initiative?

Even prior to achieving the funding from HP, Baylor University had (and has) several strengths that, especially taken together, will not be easily replicated. The already achieved proof-of-concept status of the two-course sequence in technology entrepreneurship, the demonstrated viability of the hands-on model for student learning of the “art” of technology entrepreneurship and the fully launched I5 program in China, in fact help secure their gift. Key assets from among Baylor’s unique strengths include:

- Internationally recognized programs in entrepreneurship along with several other business education disciplines (The Entrepreneurship program is ranked 14th by U.S. News and World Report and nationally ranked by Entrepreneur magazine)
- Highly ranked undergraduate engineering and computer science programs (20<sup>th</sup> among non-PhD granting Universities, U.S. News and World Report)
- Global network of partner schools and high engagement in international exchanges. This network includes a nearly 100 year relationship with University of Shanghai for Science and Technology (USST) who is partnered to launch the I<sup>5</sup> summer program in 2007.
- Sciences growing in importance and visibility through investments in facilities and surging research funding at Baylor.
- Strong support from and synergistic goals with the community efforts at economic development through nurturing technology business sector.
- Christian faith and vocational view of the meaning of work on the world’s needs and the means of addressing them through technical advancements and economic lift from job creation.

### What are the internal weaknesses that relate to the proposed initiative?

Baylor’s main gap in this arena is its lack of any commercialization or incubation space for students or faculty on campus. This gap is being addressed via the Baylor Advanced Research Institute (BARI) under direction of Vice Provost Truell Hyde and in collaboration with partners across campus and beyond, but needs to become a demonstrated reality. The multi-disciplinary nature of the program’s and courses embedded in this initiative are one of its greatest strengths, but in fact represent one of its challenges as well – innovative approaches require a great deal of effort to execute simply because they are different and it is not easy to envision all the wrinkles in advance.

### What are the external opportunities that relate to the proposed initiative?

One opportunity is for Baylor University to firmly grasp the leadership role in integrating global, cultural dynamics with the cross-disciplinary collaborative challenges implicit in engaging technical and business students in technology entrepreneurship education. There are notable “global + engineering” programs such as GEARE at Purdue University, and both “engineering + business” programs such as Technology Entrepreneurship at University of Illinois, and “business + global” programs such as our own McBride Center, but no leader has yet emerged in connecting “Science/ Engineering + Entrepreneurship + Global” into a cohesive educational program. Baylor’s summer program in International Technology Entrepreneurship over the past 3 years in Maastricht innovated this concept and the TE initiative aims to maintain that leadership and make it clearly visible in the field.

A second opportunity is implicit in the character and motivation of the students and faculty Baylor University will bring into the program. Due to its hands-on format, the student teams both on campus and on international locations will engage in ongoing collaboration with the sponsors – entrepreneurs, corporate leaders and fellow science and business practitioners. The opportunity to be a living example of a Christ-led person will open up in arenas and geographies difficult for classically mission-focused efforts to reach. The opportunity for students to explore the concepts of vocational integration of faith and serving while being mentored by faculty as they serve the sponsors overt needs (perform the project) is exceptional in its linkage of profession and calling.

### What are the external threats that relate to the proposed initiative?

The most important threat to Baylor University fulfilling this opportunity even with its numerous strengths is losing its early advantage. Secular schools that have a stronger reputation for commercialization of technology will have the power and brand strength to launch similar programs, and may be planning to do so. A second threat stems from the intensely multidisciplinary nature of the program is innovative and the newness of the type of roles it needs to create. The program will suffer for lack of access to top teaching and program development talent if the risk of “trying out” the concept is perceived as higher than the benefit to interested faculty. This translates to a need to make sure that sufficient longevity of commitments are in place for the program to become well established and perhaps calls for innovative reward scenarios for its participating faculty. The position of Clinical Professor roles in the Business School is relatively new, and does not yet exist in the Science and Engineering Schools.

## Goals and Assessment

The overarching motivation of the TE Initiative is to secure the opportunity for every Entrepreneurship, Engineering and Computer Science graduate to leave Baylor University with three clearly demonstrated competencies - technical, business, and global – and experience in using them well in a collaborative environment. This conviction has birthed the actions already well underway, and the success in raising external support in the form of a seed money grant as previously discussed.

The specific goals for this initiative are defined in that context::

1. To sustain what will be accomplished with the HP seed grant through by creating an ongoing base of external support
2. To extend that success by replicating it via mutually desired collaborations between Hankamer and other science / technology Departments such as Chemistry.

### What are the measurable goals for the proposed initiative?

Measuring progress on each of these goals is straightforward:

1. Progress in developing the Board will be measured against the targets of achieving a full board (minimum 8) membership by the end of the 3<sup>rd</sup> year after the initiative is approved.
2. Progress in financial funding will be measured against a target of annual budget growth to \$50K, \$100K and \$150K after the first, second and third years, respectively. The form of development can be split among endowment-generated funds, annual board fees, project fees and grants.
3. Progress in educational effectiveness will be tracked in terms of numbers participating and in terms of student satisfaction.
4. Much more specific goals for the program will be developed with the board members during the first year of operating the program.

## Action Plan

Note: Action plans are in place and discussed in the attached Bradley et al article regarding the course sequence development and thus are not repeated here. The following outlines the steps needed to achieve the additional goals of sustaining and extending the program.

### Developing the Board of Advisors

1. Engage the current “customer base” of companies and entrepreneurs who have sponsored projects in Waco and in China over the past two years in dialogue about the vision, the needs and the potential for program impact.  
Timetable: First 6 months
2. Develop from these interactions a finalized proposal for Board of Advisors role description and fee levels and sign on key “founder” members.  
Timetable: Complete by end of year 1.
3. Establish a Founder-led plan for targeted recruitment of remaining Advisor seats and building up to the program’s external funding goals (see above).  
Detailed plan completed at 18 month from start.
4. Execute on that plan to achieve the funding and the membership goals defined above.  
Timetable: This detailed plan will cover the next 18 months, culminating with full membership and funding.

### Additional Funding Development

1. In collaboration with the ECS and Hankamer Development leaders, we will investigate the potential of finding donors whose goals and/ or personal successes are tied sufficiently to the field of technology business to establish an endowment for the program. This funding could enable, for example, a permanent staff position of Program Coordinator.  
Timeline: This effort will be ongoing.
2. A number of foundations as well as the National Science Foundation make course and program innovation grants in the field of Technology Entrepreneurship. A review of potential grants will be undertaken, results prioritized and applications pursued. This will be particularly appropriate as the efforts are extended to other branches of science at Baylor, as one-time seed money for starting up the efforts will be needed.  
Timeline: This will be done in the first 6 months and revisited annually.

### Replication with Other Sciences

1. Preliminary discussions about connecting Chemistry students with Technology Entrepreneurship have been underway and plans begun to be formulated. This initiative will enable engagement with potential program sponsors in the chemical and pharmaceutical industries who have a vested interest because they hire Baylor graduates (primarily MS and PhD grads).
2. Detailed plans will be formulated upon locating one of two interested industrial sponsors who can take on the same role as HP has done in the development of the current programming.

## Budget Narrative

Experiences from the past two years in launching the courses, summer abroad program and in developing projects that make this hands-on method of learning feasible provide a clear picture of the resources needed. The costs fall into the categories of:

### I5 China Program Costs

- Extensive travel and time for planning and project procurement is required to execute the I5 Program in China. While Summer Abroad program fees can cover some of these costs, a high price point reduces the impact by lowering participation. Approximately \$20K per year is needed for all the exceptional costs.
- Scholarships for participation in the I5 Program. The cost to attend is approximately \$9,000 for 2008 including 6 hours tuition, and it is the goal of the program to take the most qualified students regardless of ability to pay. Full scholarship for up to 4 persons is targeted, totaling \$36,000.
- Ongoing interaction with past program participants - both sponsor companies and students - will enable Baylor to build and maintain a strong network from which to attract top students and potential industrial research sponsors. Collaboration tools such as video conferencing will be used to maintain this level of contact, and engage in projects from Waco based cohorts. The budgeted cost for these expenses is \$10,000 per year.
- A temporary half-time Program Coordinator role has been established using the grant from HP (for the next 3 years). External funding of a permanent nature is needed to expand this role to full time as the program grows, and provide all the incumbent costs. A budgetary cost for this position is \$45,000 including all overheads.

### Course Development and Optimization Costs

- Funds are needed to provide summer stipends in some form to enable participation from several disciplines in designing and optimizing technology entrepreneurship tracks within each technical discipline. In the case of ECS's two course sequence the total cost of implementation is \$25K per year for two years. Under this initiative the replication of that approach in areas such as Chem / Pharma will be budgeted at the same level.

### Use of Adjunct / Clinical Roles in Applied Teaching and Coaching

- The success of Technology Entrepreneurship over the past two years has been significantly propelled because of the degree of focus and the extent of real-world network implicit in hiring an experienced leader into a clinical role. The infusion of "fresh rolodexes" and current practices in technology based businesses will continue to be needed as new course sequence tracks are established (for example) in Chemistry. The cost can vary considerably depending on the scope of the role and the person filling it, but for budgetary purposes, the program will assume that each added role will cost \$85K. All such positions will be funded by seeking endowments and multi-year sponsorship commitments.

In total, to achieve the goals of the Initiative, these costs aggregate to \$199K per year, and this level is needed by the end of 3 years.